CLAIMS

1. A method of forming an aluminum-comprising physical vapor deposition target, comprising:

deforming an aluminum-comprising mass by equal channel angular extrusion, wherein the mass is at least 99.99% aluminum and further comprises less than or equal to about 1000 ppm of one or more dopant materials comprising elements selected from the group consisting of Ac, Ag, As, B, Ba, Be, Bi, C, Ca, Cd, Ce, Co, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ge, Hf, Ho, In, Ir, La, Lu, Mg, Mn, Mo, N, Nb, Nd, Ni, O, Os, P, Pb, Pd, Pm, Po, Pr, Pt, Pu, Ra, Rf, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Te, Ti, Tl, Tm, V, W, Y, Yb, Zn and Zr;

after the deforming, shaping the mass into at least a portion of a physical vapor deposition target.

2. The method of claim 1 wherein the physical vapor deposition target is a monolithic target.

3. The method of claim 1 wherein the one or more dopant materials comprise materials selected from the group consisting of B, Ba, Be, Ca, Ce, Co, Cr, Dy, Er, Eu, Gd, Ge, Hf, Ho, La, Ni, Nd, Pd, Pm, Pr, Sb, Sc, Si, Sm, Sr, Tb, Te, Ti, Tm, Y, Yb and Zr.

4. The method of claim 1 wherein the one or more dopant materials comprise materials selected from the group consisting of Si, Sc, Ti and Hf.

5. The method of claim 1 wherein the mass consists of aluminum and from about 10 ppm to about 100 ppm of the one or more dopant elements.

6. The method of claim 1 wherein the mass consists of Al and from about 10 ppm to about 100 ppm of one or more of Si, Sc, Ti, and Hf.

7. The method of claim 1 wherein the mass consists of Al and from about 10 ppm to about 100 ppm of Hf.

8. The method of claim 1 wherein the mass consists of Al and from about 10 ppm to about 100 ppm of Ti.

9. The method of claim 1 wherein the mass consists of Al and from about 10 ppm to about 100 ppm of Sc.

10. The method of claim 1 wherein the mass consists of Al and from about 10 ppm to about 100 ppm of Si.

11. A method of forming an aluminum-comprising physical vapor deposition target, comprising:

deforming an aluminum-comprising mass by equal channel angular extrusion; and

after the deforming, shaping the mass into at least a portion of a physical vapor deposition target, the physical vapor deposition target having an average grain size less than or equal to 45 microns.

12. The method of claim 11 wherein the mass is formed into an entirety of the physical vapor deposition target, and further comprising mounting the mass to a backing plate.

13. The method of claim 11 wherein the mass is at least 99.99% aluminum and consists of Al and less than 100 ppm of one or more of Si, Sc, Ti and Hf.

14. The method of claim 11 wherein the mass is at least 99.99% aluminum, and further comprises greater than 0 ppm and less than or equal to about 100 ppm of one or more dopant materials comprising elements selected from the group consisting of Ac, Ag, As, B, Ba, Be, Bi, C, Ca, Cd, Ce, Co, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ge, Hf, Ho, In, Ir, La, Lu, Mg, Mn, Mo, N, Nb, Nd, Ni, O, Os, P, Pb, Pd, Pm, Po, Pr, Pt, Pu, Ra, Rf, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Te, Ti, Tl, Tm, V, W, Y, Yb, Zn and Zr.

15. The method of claim 11 wherein the mass consists essentially of aluminum.

16. The method of claim 11 wherein the mass consists essentially of aluminum, and less than or equal to about 100 ppm of one or more dopant materials comprising elements selected from the group consisting of Ac, Ag, As, B, Ba, Be, Bi, C, Ca, Cd, Ce, Co, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ge, Hf, Ho, In, Ir, La, Lu, Mg, Mn, Mo, N, Nb, Nd, Ni, O, Os, P, Pb, Pd, Pm, Po, Pr, Pt, Pu, Ra, Rf, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Te, Ti, Tl, Tm, V, W, Y, Yb, Zn and Zr.

17. The method of claim 11 wherein the shaping comprises one or more of forging and rolling of the aluminum-comprising mass at a temperature of less than or equal to about 200°C.

18. The method of claim 11 wherein the deforming comprises at least three extruding steps, each of the at least three extruding steps comprising passing the mass through two intersecting passages having approximately equal cross-sections.

19. The method of claim 11 wherein the deforming comprises at least four extruding steps, each of the at least four extruding steps comprising passing the mass through two intersecting passages having approximately equal cross-sections.

20. The method of claim 11 wherein the deforming comprises at least six extruding steps, each of the at least six extruding steps comprising passing the mass through two intersecting passages having approximately equal cross-sections.

21. A physical vapor deposition target consisting essentially of aluminum and less than or equal to 1000 ppm of one or more dopant materials comprising elements selected from the group consisting of Ac, Ag, As, B, Ba, Be, Bi, C, Ca, Cd, Ce, Co, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ge, Hf, Ho, In, Ir, La, Lu, Mg, Mn, Mo, N, Nb, Nd, Ni, O, Os, P, Pb, Pd, Pm, Po, Pr, Pt, Pu, Ra, Rf, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Te, Ti, Tl, Tm, V, W, Y, Yb, Zn and Zr; the physical vapor deposition target having an average grain size of less than 100 microns.

22. The physical vapor deposition target of claim 21 having an average grain size of less than or equal to 45 microns.

23. The physical vapor deposition target of claim 21 consisting of Al and less than 100 ppm of one or more of Si, Sc, Ti; and Hf.

24. The physical vapor deposition target of claim 21 consisting of Al and from 10 ppm to100 ppm of one or more of Si, Sc, Ti; and Hf.

25. The physical vapor deposition target of claim 21 consisting of Al and from 10 ppm to 100 ppm of Sc; the target having an average grain size of less than or equal to 45 microns.

26. The physical vapor deposition target of claim 21 consisting of Al and from 10 ppm to 100 ppm of Si; the target having an average grain size of less than or equal to 35 microns.

27. The physical vapor deposition target of claim 21 consisting of Al and from 10 ppm to 100 ppm of Ti.

28. The physical vapor deposition target of claim 21 consisting of Al and from 10 ppm to 100 ppm of Hf.

29. A film sputtered from a target, the film consisting essentially of aluminum and less than or equal to 1000 ppm of one or more dopant materials comprising elements selected from the group consisting of Ac, Ag, As, B, Ba, Be, Bi, C, Ca, Cd, Ce, Co, Cr, Cu, Dy, Er, Eu, Fe, Ga, Gd, Ge, Hf, Ho, In, Ir, La, Lu, Mg, Mn, Mo, N, Nb, Nd, Ni, O, Os, P, Pb, Pd, Pm, Po, Pr, Pt, Pu, Ra, Rf, Rh, Ru, S, Sb, Sc, Se, Si, Sm, Sn, Sr, Ta, Tb, Te, Ti, Tl, Tm, V, W, Y, Yb, Zn and Zr.

30. The film of claim 29 consisting of Al and less than 100 ppm of one or more of Si, Sc, Ti and Hf.

31. The film of claim 29 consisting of Al and from 10 ppm to100 ppm of one or more of Si, Sc, Ti and Hf.